

Council on Postsecondary Education
November 8, 2004

Statewide Public Postsecondary Placement Policy

At its March meeting, the Council on Postsecondary Education directed Kentucky's public postsecondary institutions to develop a statewide placement policy based on research conducted during Kentucky's participation in the American Diploma Project.

Action: The staff recommends that the Council approve the attached statewide placement policy guaranteeing placement into credit-bearing coursework to any student entering a Kentucky public postsecondary institution who is able to demonstrate specific levels of competence in English and mathematics (see Attachments 1-3).

Kentucky was one of five states competitively selected to participate in the American Diploma Project, a national initiative to align high school standards with postsecondary and workplace expectations so high school graduates can succeed in whatever challenges they face after graduation. Based on research conducted nationwide among postsecondary faculty and employers in skilled occupations, the ADP report, *Ready or Not: Creating a High School Diploma that Counts*, outlines the skills in mathematics and English that students graduating from high school should have to be ready for college-level work or employment in the skilled workplace. It also provides sample tasks illustrating how these benchmarks are applied in college and workplace settings.

Following the release of the ADP report in February 2004, the Council directed Kentucky's public postsecondary institutions to review the benchmarks in English and mathematics and to develop a consistent statewide placement policy that guarantees placement into credit-bearing coursework in English and mathematics to any incoming student—high school graduate or adult learner—who can demonstrate readiness for college. The CPE staff convened statewide placement policy groups in these two areas. Each group consists of one representative from each of the eight public universities chosen by the chief academic officer at that institution and one representative from the Kentucky Community and Technical College System (Attachment 4).

The policy work groups met over the summer and fall and developed a statewide policy that faculty members shared with their institutional colleagues and chief academic officers. They drafted recommendations which were discussed at the September meeting of the Council of Chief Academic Officers and presented at the September meeting of the state P-16 Council.

The goal of the ADP was to align high school accountability standards with the expectations of college and the skilled workplace. Ideally, each state's high school accountability measures would be modified, based on the ADP research, to meet these expectations so students would clearly understand the connection between high school study and life after graduation. At this time, Kentucky's high school Commonwealth Accountability Testing System (CATS) scores cannot be used for this purpose. The CATS is currently under review. Changes in the test over the coming year may allow it to be included in the placement policy at some future date.

A clear and consistent statewide postsecondary placement policy, however, can reduce remediation rates by communicating to high school students and adult learners what any entering college student is expected to know and be able to do to be ready for college-level work in English and mathematics. If approved, the policy will be broadly communicated to traditional and adult learners, teachers, and parents throughout the state.

Kentucky Statewide Public Postsecondary Placement Policy in English and Mathematics

The statewide placement policy is *applicable to any incoming student entering a Kentucky public postsecondary institution*. It provides guidance for students, teachers, parents, school counselors, and school administrators, as well as adult learners and those who prepare them for postsecondary education. ACT standards form the basis of the policy because Kentucky uses the ACT (or equivalent measures) for college admissions and placement decisions.

Kentucky Statewide Placement Policy in English

- A student earning an ACT English sub-score of *18 or higher* qualifies for placement in a credit-bearing writing course at any Kentucky public postsecondary institution.

Kentucky Statewide Placement Policy in Mathematics

Three levels of readiness are identified for placement in a credit-bearing mathematics course at any Kentucky public postsecondary institution:

- Level 1: A student earning an ACT mathematics sub-score of *19 or higher* qualifies for placement in a credit-bearing mathematics course, but this course may not be a requirement for many college majors or lead to subsequent coursework in mathematics. Mathematics for liberal arts is an example of such a course.
- Level 2: A student earning an ACT mathematics sub-score of *22 or higher* qualifies for placement in college algebra. College algebra (or placement in more advanced courses) is required for majors such as biology, business, economics, information systems, and technology. College algebra can lead to *any* major.
- Level 3: A student earning an ACT mathematics sub-score of *27 or higher* qualifies for placement in calculus. Calculus is required for majors such as mathematics, physics, chemistry, computer science, engineering, biology, business, and technology.

Kentucky's statewide public postsecondary placement policy is a guarantee of placement in credit-bearing coursework to incoming students demonstrating specified levels of competence. It does not guarantee admission to any institution. It does not mandate remedial placement of students earning less than one of the ACT required scores. Students who do not meet these statewide thresholds in mathematics (but who have an ACT of 18 or higher) will be placed according to institutional determination.

Kentucky's statewide public postsecondary placement policy complements the state's Minimum Admissions Policy, which holds Kentucky's public postsecondary institutions responsible for providing supplemental academic assistance to any underprepared student admitted (defined as having an ACT sub-score below 18 in mathematics, English, or reading).

The required scores in this policy measure acquisition of specific skills comprising college readiness in English and mathematics. In order to supply clear and specific guidelines for college readiness, beyond a test score, these skills are described in Attachments 2 and 3.

All the skills outlined are significant. Certain skills are prioritized as "gateway" skills because students who lack these specific skills are likely to require remedial coursework, which is costly both in terms of time and tuition dollars. Other skills, also important, but which could be acquired in college, or which are not normally assessed for remedial placement purposes, are listed after the gateway skills. Such prioritization should not be interpreted as indicating that these skills should be neglected in high school or adult education preparation.

The Council on Postsecondary Education and Kentucky's postsecondary faculty encourage a rigorous, academically challenging curriculum for *all* high school students and adult learners. They made the following observations and recommendations for all students who plan to enter college or be successfully employed after high school:

- Reading across a broad range of genres, including fiction, poetry, drama, and non-fiction, has a significant beneficial effect on writing, critical thinking, and the ability to appreciate perspectives other than one's own.
- Analytical writing strengthens the ability to think critically.
 - The ability to write clear, lucid prose, unedited by others and within a time limit, is a skill that students will need throughout their college careers and beyond.
 - The ability to research a problem and marshal evidence and documentation in support of a position is a skill that will support success across college disciplines and in the workplace.
- The study of mathematics strengthens the ability to reason, and (as national research has shown) the level of mathematics one studies in high school serves as the single greatest predictor of college completion.
- The time-consuming and labor-intensive nature of the study of algebra requires that special attention be devoted to this topic prior to college.

Kentucky Statewide College-Readiness Standards in English

1. **The following are basic gateway skills in English, indicating teachability at the college level. Inability to demonstrate these skills is likely to require remedy in the form of non-credit-bearing coursework. If able to demonstrate these skills, a student is likely to be placed in credit-bearing coursework.**

It is essential that an entering college student can do the following.

Language

- A. Demonstrate control of standard English through the use of grammar, punctuation, capitalization, and spelling.
- B. Use general and specialized dictionaries, thesauruses, and glossaries (print and electronic) to determine the definition, pronunciation, etymology, spelling, and usage of words.
- C. Use roots, affixes, and cognates to determine the meaning of unfamiliar words.
- D. Use context to determine the meaning of unfamiliar words.
- E. Recognize nuances in the meanings of words; choose words precisely to enhance communication.
- F. Give and follow spoken instructions to perform specific tasks, answer questions, and solve problems.
- G. Participate productively in self-directed work teams for a particular purpose (for example, to interpret literature, write or critique a proposal, solve a problem, make a decision), including:
 - Posing relevant questions.
 - Listening with civility to the ideas of others.
 - Extracting essential information from others' input.
 - Building on the ideas of others and contributing relevant information or ideas in group discussions.
 - Consulting texts as a source of ideas.
 - Gaining the floor in respectful ways.
 - Defining individuals' roles and responsibilities and setting clear goals.
 - Acknowledging the ideas and contributions of individuals in the group.
 - Understanding the purpose of the team project and the ground rules for decision-making.
 - Maintaining independence of judgment, offering dissent courteously, ensuring a hearing for the range of positions on an issue, and avoiding premature consensus.
 - Tolerating ambiguity and a lack of consensus.
 - Selecting a leader/spokesperson when necessary.

Writing

- H. Plan writing by taking notes, writing informal outlines, and researching.
- I. Select and use formal, informal, literary, or technical language appropriate for the purpose, audience, and context of the communication.
- J. Organize ideas in writing with a thesis statement in the introduction, well-constructed paragraphs, a conclusion, and transition sentences that connect paragraphs into a coherent whole.
- K. Drawing on readers' comments on working drafts, revise documents to develop or support ideas more clearly, address potential objections, ensure effective transition between paragraphs, and correct errors in logic.
- L. Edit both one's own and others' work for grammar, style, and tone appropriate to audience, purpose, and context.
- M. Write an analytic essay (for example, an explanation, a critique, an argument, or a literary analysis) that:
 - Develops a thesis.
 - Creates an organizing structure appropriate to purpose, audience, and context.
 - Includes relevant information and excludes extraneous information.
 - Makes valid inferences.
 - Supports judgments with relevant and substantial evidence and well-chosen details.
 - Provides a coherent conclusion.
- N. Define and narrow a problem or research topic.

Logic

- O. Distinguish among facts, opinions, evidence, and inferences.
- P. Construct arguments that:
 - Develop a thesis that demonstrates clear and knowledgeable judgment.
 - Structure ideas in a sustained and logical fashion.
 - Use a range of strategies to elaborate and persuade, such as descriptions, anecdotes, case studies, analogies, and illustrations.
 - Clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations, and/or expressions of commonly accepted beliefs, and logical reasoning.
 - Anticipate and address the reader's concerns and counterclaims.
 - Provide clear and effective conclusions.

Informational Text

- Q. Follow instructions in informational texts to perform specific tasks, answer questions, or solve problems.
- R. Identify the main ideas of informational text and determine the essential elements that elaborate them.
- S. Distinguish between a summary and a critique.
- T. Identify interrelationships between and among ideas and concepts, such as cause-and-effect relationships, within a text.
- U. Draw conclusions based on evidence from texts.
- V. Analyze the ways in which a text's organizational structure supports or confounds its meaning or purpose.
- W. Recognize and evaluate the use of ambiguity, contradiction, paradox, irony, incongruities, overstatement, and understatement in texts.

Literature

- X. Interpret significant works from various forms of literature: poetry, novel, biography, short story, essay, and dramatic literature; use understanding of genre characteristics to make deep and subtle interpretations of the meaning of the text.
- Y. Analyze the setting, plot, theme, characterization, and narration of classic and contemporary short stories and novels.

2. The following competencies are assumed as prerequisite but are not normally tested for placement purposes to determine college-readiness.

Communication

- A. Summarize information presented orally by others.
- B. Paraphrase information presented orally by others.
- C. Identify the thesis of a speech and determine the essential elements that elaborate it.
- D. Analyze the ways in which the style and structure of a speech support or confound its meaning or purpose.

Research

- E. Report findings within prescribed time and/or length requirements, as appropriate.

Informational Text

- F. Summarize informational and technical texts and explain the visual components that support them.

3. These are valuable survival skills for all college-level work, though not necessarily prerequisite for entry-level English courses.

Communication

- A. Make oral presentations that:
- Exhibit a logical structure appropriate to the audience, context, and purpose.
 - Group related ideas and maintain a consistent focus.
 - Include smooth transitions.
 - Support judgments with sound evidence and well-chosen details.
 - Make skillful use of theatrical devices.
 - Provide a coherent conclusion.
 - Employ proper eye contact, speaking rate, volume, enunciation, inflection, and gestures to communicate ideas effectively.

Writing

- B. Determine how, when, and whether to employ technologies (such as computer software, photographs, and video) in lieu of, or in addition to, written communication.
- C. Present written material using basic software programs (such as Word, Excel, and PowerPoint) and graphics (such as charts, ratios, and tables) to present information and ideas best understood visually.

Research

- D. Gather relevant information from a variety of print and electronic sources, as well as from direct observation, interviews, and surveys.
- E. Make distinctions about the credibility, reliability, consistency, strengths, and limitations of resources, including information gathered from Web sites.
- F. Write an extended research essay (approximately six to ten pages), building on primary and secondary sources, that:
- Marshals evidence in support of a clear thesis statement and related claims.

- Paraphrases and summarizes with accuracy and fidelity the range of arguments and evidence supporting or refuting the thesis, as appropriate.
- Cites sources correctly and documents quotations, paraphrases, and other information using a standard format.

Informational Text

- G. Interpret and use information in maps, charts, graphs, time lines, tables, and diagrams.
- H. Synthesize information from multiple sources.
- I. Evaluate texts for their clarity, simplicity, and coherence and for the appropriateness of their graphics and visual appeal.

Media

- J. Evaluate the aural, visual, and written images, and other special effects used in television, radio, film, and the Internet for their ability to inform, persuade, and entertain (for example, anecdote, expert witness, vivid detail, tearful testimony, and humor).
- K. Examine the intersections and conflicts between the visual (such as media images, painting, film, and graphic arts) and the verbal.
- L. Recognize how visual and sound techniques or design (such as special effects, camera angles, and music) carry or influence messages in various media.
- M. Apply and adapt the principles of written composition to create coherent media productions using effective images, text, graphics, music, and/or sound effects—if possible—and present a distinctive point of view on a topic (for example, PowerPoint presentations, videos).

4. These skills are valuable, but they could be taught and acquired in college:

Language

- A. Identify the meaning of common idioms, as well as literary, classical, and biblical allusions.
- B. Comprehend and communicate quantitative, technical, and mathematical information.

Writing

- C. Cite print or electronic sources properly when paraphrasing or summarizing information, quoting, or using graphics.
- D. Produce work-related texts (for example, memos, emails, correspondence, project plans, work orders, proposals, and bios) that:
 - Address audience needs, stated purpose, and context; translate technical language into non-technical English.

- Include relevant information and exclude extraneous information.
- Use appropriate strategies, such as providing facts and details, describing or analyzing the subject, explaining benefits or limitations, comparing or contrasting, and providing a scenario to illustrate.
- Anticipate potential problems, mistakes, and misunderstandings that might arise for the reader; create predictable structures through the use of headings, white space, and graphics, as appropriate.
- Adopt a customary format, including proper salutation, closing, and signature, when appropriate.

Logic

- E. Describe the structure of a given argument; identify its claims and evidence; and evaluate connections among evidence, inferences, and claims.
- F. Evaluate the range and quality of evidence used to support or oppose an argument.
- G. Recognize common logical fallacies, such as the appeal to pity (*argumentum ad misericordiam*), the personal attack (*argumentum ad hominem*), the appeal to common opinion (*argumentum ad populum*), and the false dilemma (assuming only two options when there are more options available); understand why these fallacies do not support the point being argued.
- H. Analyze written or oral communications for false assumptions, errors, loaded terms, caricature, sarcasm, leading questions, and faulty reasoning.
- I. Understand the distinction between a deductive argument (in which, if the premises are all true and the argument's form is valid, the conclusion is inescapably true) and an inductive argument (in which the conclusion provides the best or most probable explanation of the truth of the premises, but is not necessarily true).
- J. Analyze two or more texts addressing the same topic to determine how authors reach similar or different conclusions.

Literature

- K. Demonstrate knowledge of significant works of literature.
- L. Analyze foundational U.S. documents for their historical and literary significance (for example, The Declaration of Independence, the Preamble to the U.S. Constitution, Abraham Lincoln's "Gettysburg Address," Martin Luther King, Jr.'s "Letter from Birmingham Jail").
- M. Demonstrate knowledge of metrics, rhyme scheme, rhythm, alliteration, and other conventions of verse in poetry.
- N. Identify how elements of dramatic literature (for example, dramatic irony, soliloquy, stage direction, and dialogue) articulate a playwright's vision.

Kentucky Statewide College-Readiness Standards in Mathematics

- 1. The following are essential gateway mathematical skills that students should have in order to avoid placement into remedial (non-credit-bearing) mathematics courses and to succeed in *any* entry-level, credit-bearing mathematics course. Students who do not develop these skills in high school significantly reduce their chances for success in college and restrict their choice of college majors and career options.**

It is essential that an entering college student can do the following.

Number Sense and Numerical Operations

- A. Compute fluently and accurately with rational numbers without a calculator:
 - Add, subtract, multiply and divide integers, fractions and decimals.
 - Calculate and apply ratios, proportions, rates, and percentages to solve problems.
 - Use the correct order of operations to evaluate arithmetic expressions, including those containing parentheses.
 - Explain and apply the basic number theory concepts such as prime number, factor, divisibility, least common multiple, and greatest common divisor.
 - Multiply and divide numbers expressed in scientific notation.
- B. Recognize and apply magnitude (absolute value) and ordering of real numbers:
 - Locate the position of a number on the number line, know that its distance from the origin is its absolute value, and know that the distance between two numbers on the number line is the absolute value of their difference.
 - Determine the relative position on the number line of numbers and the relative magnitude of numbers expressed in fractional form, in decimal form, as roots, or in scientific notation.
- C. Understand that in order to solve certain problems and equations, number systems need to be extended from whole numbers to the set of all integers (positive, negative, and zero), from integers to rational numbers, from rational numbers to real numbers (rational and irrational numbers), from real numbers to complex numbers, and define and give examples of each of these types of numbers.

Algebra

- D. Perform basic operations with algebraic expressions fluently and accurately:
 - Understand the properties of integer exponents and roots and apply these properties to simplify algebraic expressions.
 - Understand the properties of rational exponents and apply these properties to simplify algebraic expressions.
 - Add, subtract, and multiply polynomials. Divide a polynomial by a low degree polynomial.

- Factor polynomials by removing the greatest common factor and factor quadratic polynomials.
 - Add, subtract, multiply, divide, and simplify rational expressions.
 - Evaluate polynomial and rational expressions and expressions containing radicals and absolute values—at specified values of their variables.
- E. Understand functions, their representations, and their properties:
- Recognize whether a relationship given in symbolic or graphical form is a function.
 - Understand functional notation and evaluate a function at a specified point in its domain.
- F. Apply basic algebraic operations to solve equations and inequalities:
- Solve linear equations and inequalities in one variable including those involving an absolute value.
 - Solve an equation involving several variables for one variable in terms of the others.
 - Solve systems of two linear equations in two variables.
 - Solve quadratic equations in one variable.
- G. Graph a variety of equations and inequalities in two variables, demonstrate understanding of the relationships between the algebraic properties of an equation and the geometric properties of its graph, and interpret a graph:
- Graph a linear equation and demonstrate that it has a constant rate of change.
 - Understand the relationship between the coefficients of a linear equation and the slope and x and y intercepts of its graph.
 - Understand the relationship between a solution of a system of two linear equations in two variables and the graphs of the corresponding lines.
 - Graph the solution set of a linear inequality.
 - Graph a quadratic function and understand the relationship between its real zeros and the x-intercepts of its graph.
 - Graph exponential functions and identify their key characteristics.
 - Read information and draw conclusions from graphs; identify properties of a graph that provide useful information about the original problem.
- H. Solve problems by converting the verbal information given into an appropriate mathematical model involving equations or systems of equations; apply appropriate mathematical techniques to analyze these mathematical models; and interpret the solution obtained in written form using appropriate units of measurement:
- Recognize and solve problems that can be modeled using a linear equation in one variable, such as time/rate/distance problems, percentage increase or decrease problems, and ratio and proportion problems.
 - Recognize and solve problems that can be modeled using a system of two equations in two variables.
 - Recognize and solve problems that can be modeled using a quadratic equation, such as the motion of an object under the force of gravity.
 - Recognize and solve problems that can be modeled using an exponential function, such as compound interest problems.

Geometry

- I. Understand the different roles played by axioms, definitions, and theorems in the logical structure of mathematics, especially in geometry:
 - Identify, explain the necessity of, and give examples of definitions, axioms, and theorems.
 - State and use key basic theorems in geometry such as the Pythagorean theorem, the sum of the angles of a triangle is 180 degrees, the line joining the midpoints of two sides of a triangle is parallel to the third side and half its length.
- J. Identify and apply the definitions and properties related to lines and angles and use them to solve problems:
 - Identify and apply properties of and theorems about parallel lines.
 - Identify and apply properties of and theorems about perpendicular lines.
 - Identify and apply properties of and theorems about angles.
- K. Understand the basic theorems about congruent and similar triangles and use them to solve problems.
- L. Understand the definitions and basic properties of a circle and use them to solve problems.
- M. Apply the Pythagorean theorem, its converse, and properties of special right triangles to solve problems.
- N. Use the concept of similarity of figures to solve problems.
- O. Know that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit and that measurements made on physical objects are approximations; calculate the measurements of common plane and solid geometric figures:
 - Understand that numerical values are associated with measurements of physical quantities and must be assigned units of measurement or dimensions; apply such units correctly in expressions, equations, and problem solutions that involve measurements; and convert a measurement using one unit of measurement to another unit of measurement.
 - Determine the perimeter of a polygon and the circumference of a circle, the area of a rectangle, circle, triangle, and a polygon with more than four sides by decomposing it into triangles, the surface area of a prism, a pyramid, a cone, and a sphere, and the volume of a prism (for example, a rectangular box), a pyramid, a cone, and a sphere.
 - Know that the effect of a scale factor k on length, area, and volume is to multiply each by k , k^2 , and k^3 , respectively.
- P. Represent geometric objects and figures algebraically using coordinates; use algebra to solve geometric problems:
 - Express the intuitive concept of the “slant” of a line in terms of the precise concept of slope, use the coordinates of two points on a line to define its slope, and use slope to express the parallelism and perpendicularity of lines.

- Describe a line by a linear equation.
- Find the distance between two points using their coordinates and the Pythagorean theorem.
- Find an equation of a circle given its center and radius.

Q. Understand basic right-triangle trigonometry and apply it to solve problems:

- Understand how similarity of right triangles allows the trigonometric function, sine, cosine, and tangent to be defined as ratios of sides, and be able to use these functions to solve problems.
- Apply the trigonometric functions sine, cosine and tangent to solve for an unknown length of a side of a right triangle, given one of the acute angles and the length of another side.

Data Interpretation, Statistics, and Probability

R. Explain and apply quantitative information:

- Organize and display data using appropriate methods (including spreadsheets) to detect patterns and departures from patterns.
- Read and interpret tables, charts, and graphs.
- Compute and explain summary statistics for distributions of data including measures of center (mean, median) and spread (range, percentiles, variance, and standard deviation).

2. The following skills are valuable but can be acquired while enrolled in a college-level, credit-bearing course. This does not, however, minimize their importance in the high school curriculum.

Number Sense and Numerical Operations

A. Understand the capabilities and the limitations of calculators and computers in solving problems:

- Use calculators appropriately and make estimations without a calculator regularly to detect potential errors.
- Use graphing calculators and computer spreadsheets.

Algebra

B. Perform basic operations on algebraic expressions fluently and accurately (additional skill):

- Derive and use the formulas for the general term and summation of finite arithmetic and geometric series and infinite geometric series with common ratio r in the interval $(-1,1)$.

C. Graph a variety of equations and inequalities in two variables, demonstrate understanding of the relationships between the algebraic properties of an equation and the geometric properties of its graph, and interpret a graph (additional skill):

- Graph ellipses and hyperbolas whose axes are parallel to the x and y axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.
- D. Solve problems by converting the verbal information given into an appropriate mathematical model involving equations or systems of equations; apply appropriate mathematical techniques to analyze these mathematical models; and interpret the solution obtained in written form using appropriate units of measurement (additional skills):
- Recognize and solve problems that can be modeled using a finite geometric series, such as home mortgage problems and other compound interest problems.
 - Recognize and solve problems that can be modeled using an exponential function but whose solution requires facility with logarithms, such as exponential growth and decay problems.

Geometry

- E. Visualize solids and surfaces in three-dimensional space when given two-dimensional representations (for example, nets, multiple views) and create two-dimensional representations for the surfaces of three-dimensional objects.

Data Interpretation, Statistics and Probability

- F. Explain and apply quantitative information (additional skills):
- Compare data sets using graphs and summary statistics.
 - Create scatter plots, analyze patterns, and describe relationships in paired data.
 - Know the characteristics of the Gaussian normal distribution (bell-shaped curve).
- G. Explain and criticize alternative ways of presenting and using information:
- Evaluate reports based on data published in the media by considering the source of the data, the design of the study, and the way the data are analyzed and displayed.
 - Identify and explain misleading uses of data.
 - Recognize when arguments based on data confuse correlation with causation.
- H. Explain the use of data and statistical thinking to draw inferences, make predictions, and justify conclusions:
- Explain the impact of sampling methods, bias, and the phrasing of questions asked during data collection and the conclusions that can be rightfully made.
 - Design simple experiments or investigations to collect data to answer questions of interest.
 - Explain the differences between randomized experiments and observational studies.
 - Construct a scatter plot of a set of paired data and if it demonstrates a linear trend, use a graphing calculator to find the regression line that best fits this data. Recognize that the correlation coefficient measures goodness of fit and explain when it is appropriate to use the regression line to make predictions.

- I. Explain and apply probability concepts and calculate simple probabilities:
 - Explain how probability quantifies the likelihood that an event occurs in terms of numbers.
 - Explain how the relative frequency of a specified outcome of an event can be used to estimate the probability of the outcome.
 - Explain how the Law of Large Numbers can be applied in simple examples.
 - Apply probability concepts such as conditional probability and independent events to calculate simple probabilities.
 - Apply probability concepts to practical situations to make informed decisions.

3. **The following mathematical skills are essential, together with the skills in category 1, for students whose intended majors require calculus and who expect to begin college taking calculus. Such majors include mathematics, physics, chemistry, computer science, engineering, biology, and business.**

Algebra

- A. Understand functions, their representations, and their properties (additional skills):
 - Determine the domain of a function represented in either symbolic or graphical form.
 - Combine functions by composition, as well as by addition, subtraction, multiplication, and division.
 - Identify whether a function has an inverse and when functions are inverses of each other; explain why the graph of a function and its inverse are reflections of one another over the line $y = x$.
 - Know that the inverse of an exponential function is a logarithmic function, prove basic properties of a logarithm using properties of its inverse, and apply those properties to solve problems.

- B. Understand the Binomial theorem and its connections to combinatorics, Pascal's Triangle, and probability.

Geometry

- C. Understand the different roles played by axioms, definitions, and theorems in the logical structure of mathematics, especially in geometry (deepened skill):
 - Prove key basic theorems in geometry such as the Pythagorean theorem, the sum of the angles of a triangle is 180 degrees, and the line joining the midpoints of two sides of a triangle is parallel to the third side and half its length.
 - Prove basic theorems about congruent and similar triangles (deepened skill).
 - Prove basic theorems about circles (deepened skill):

- D. Use rigid motions (compositions of reflections, translations, and rotations) to determine whether two geometric figures are congruent and to create and analyze geometric designs.

- E. Represent geometric objects and figures algebraically using coordinates; use algebra to solve geometric problems (additional skill):
- Given an equation of a circle, find its center and radius (deepened skill).
- F. Know how the trigonometric functions can be extended to periodic functions on the real line, derive basic formulas involving these functions, and use these functions and formulas to solve problems.
- Know that the trigonometric functions sine and cosine, and thus all trigonometric functions, can be extended to periodic functions on the real line by defining them as functions on the unit circle, that radian measure of an angle between 0 and 360 degrees is the arc length of the unit circle subtended by that central angle, and that by similarity the arc length “s” of a circle of radius “r” subtended by a central angle of measure t radians is $s=rt$.
 - Know and use the basic identities, such as $\sin^2(x) + \cos^2(x) = 1$ and $\cos\left(\frac{\pi}{2} - x\right) = \sin(x)$, and formulas for sine and cosine, such as addition and double angle formulas.
 - Graph sine, cosine, and tangent as well as their reciprocals cosecant, secant, and cotangent functions; identify key characteristics.
 - Know and use the law of cosines and the law of sines to find missing sides and angles of a triangle.

English Postsecondary Placement Policy Group Members

Ted Brown
Associate Professor
Department of English and Philosophy
Interim Assistant Dean
College of Humanities and Fine Arts
Murray State University

Sharon K. Burton
Associate Professor
Department of English
English Program Coordinator
Henderson Community College

Sue Cain
Director
Developmental Education and
Academic Testing
Eastern Kentucky University

Jonathan S. Cullick
Assistant Professor
Department of Literature and Language
Director of University Writing Program
Northern Kentucky University

John Hagaman
Professor
Department of English
Director of Writing Project
Western Kentucky University

David Howarth
Associate Provost and
Dean of Undergraduate Studies
University of Louisville

Layne Neeper
Associate Professor
Department of English, Foreign Languages,
and Philosophy
Morehead State University

Ellen Rosenman
Chair
Department of English
University of Kentucky

George Shields
Professor, Department of Philosophy
Chair, Division of Literature, Language, and
Philosophy
Kentucky State University

Mathematics Postsecondary Placement Policy Group Members

Donald Bennett
Professor and Chair
Department of Mathematics and Statistics
Murray State University

Fariba Bigdeli-Jahed
Associate Professor
Department of Mathematics
Chair
Division of Mathematics and Sciences
Kentucky State University

Jane Brantley
Instructor
Department of Mathematics
Western Kentucky University

Karen Sue Cain
Director
Developmental Education and
Academic Testing
Assistant Professor
Department of Mathematics and Statistics
Eastern Kentucky University

Paul Eakin
Professor
Department of Mathematics
University of Kentucky

Steve Newman
Professor
Department of Mathematics and
Computer Science
Northern Kentucky University

Christopher Schroeder
Assistant Professor
Department of Mathematics and
Computer Science
Morehead State University

Gail Stringer
Professor
Mathematics
Somerset Community College

W. Wiley Williams
Professor
Mathematics
University of Louisville